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Case Report

Extra-neural metastases of recurrent myxopapillary ependymoma: A patient case and literature review

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Received: 21 February 2025
Accepted: 14 April 2025
Published: 16 May 2025

DOI
10.25259/SNI_190_2025

Quick Response Code:

ABSTRACT

Background: Biologically and morphologically distinct from other ependymomas, myxopapillary ependymomas (MPEs) are rare, slow-growing glial tumors originating predominantly from the conus medullaris, cauda equina, or filum terminale. Gross total resection is the standard of care for primary MPE. Nevertheless, despite maximal resection, the risk of recurrence, usually within the neural axis, remains high. However, extra-neural metastases can also occur. Due to the rarity of the entity, there is a lack of consensus on the management of recurrences and extra-neural metastatic disease. We present a case report and literature review of this rare ependymal tumor.

Case Description: We describe a case of a male patient with MPE who developed multiple recurrences, treated with numerous surgical resections, radiotherapy, and salvage chemotherapy before eventually developing extra-neural metastatic disease to lungs, abdomen, and lymph nodes 37 years after initial diagnosis. A biopsy of an axillary lymph node confirmed histomorphology comparable to the primary histology.

Conclusion: To our knowledge, there are <30 cases of extra-craniospinal metastatic MPE reported since 1955. Consequently, there is no major consensus on the treatment of extra-neural metastatic MPE. Case reports and series remain of utter importance to share experience and help customize management. From this angle, surgery, and radiotherapy are still used in the face of central nervous system recurrence and "limited" extra-neural spread, depending on the patterns of invasion. Chemotherapy has shown a modest effect so far; however, positive outcomes from targeted agents and immunotherapy (alone or combined) have been reported, which warrants further exploration.

Keywords: Metastases, Myxopapillary ependymoma, Spine

INTRODUCTION

Biologically and morphologically distinct from other ependymomas,[1,14] myxopapillary ependymomas (MPEs) are rare, slow-growing glial tumors originating predominantly from the conus medullaris, cauda equina, or filum terminale.[2,14] Originally classified as grade 1 tumors, MPE was upgraded by the World Health Organization (WHO) to grade 2 neoplasms in 2021.[14]

As such, MPE tends to recur, primarily locally, sometimes distally within the central nervous system (CNS) and rarely extra-neural.[13] Mastantuoni *et al.* conducted a literature review and found only 14 cases of extra-neural, metastatic MPE between 1955 and 2012, as well as reporting their case of metastatic MPE arising in paravertebral muscles in 2022.[16] We present a complex case of metastatic MPE, to our knowledge, one of the longest surviving cases reported in recent

times; in addition, we analyze the intrinsic behavior of the disease and discuss possible treatment strategies. The case report is complemented by a review of cases in the medical literature between 2012 and 2024 (PubMed). All materials relevant to this case were collected from University Hospital Southampton's (UHSs) multi-departmental database, including those from Neurosurgery, Oncology, Radiology, and Pathology. Correspondingly, all treatment modalities described in the case were also delivered at UHS.

CASE DESCRIPTION

In 1986, a 24-year-old male presented to our hospital, UHS, with a year's history of low back pain and right calf pain on exertion. The pain persisted despite a visit to the Chiropractor, an epidural injection, and analgesia. Shortly after, the patient developed right leg weakness with associated numbness in the soles of his feet; he also reported difficulty sustaining an erection, abnormal sensation on passing urine, and difficulty micturating. On emergency admission to the Spinal Unit, he had no relevant past medical history and was taking ibuprofen. A myelogram confirmed a complete block at T12, and cerebral spinal fluid (CSF) was slightly raised at 710 mg/L. An intramedullary lesion extending from T12 to the conus was suspected. He subsequently underwent a T12-L3 laminectomy and subtotal excision of the conus lesion at UHS. The ensuing histology showed papillae surrounded by myxoid material with strong diffuse staining for glial fibrillary acidic protein, findings consistent with a Myxopapillary Ependymoma World Health Organization (WHO) grade 1 (as per 2016 WHO classification and prior publications from 1979, 1993, 2000, and 2007) [Figure 1]. His lower back pain, right sciatic symptoms, and sensation resolved with residual mild weakness of right foot eversion postoperatively. Following a multidisciplinary discussion, he received adjuvant radiotherapy to T11 to S2 inclusive (40 Gy in 20 fractions) at UHS.

Approximately 20 months after his initial presentation (1988), he presented with a 3-week history of pain above his laminectomy site associated with paroxysmal, bilateral lower limb numbness. A repeat myelogram revealed a total block opposite T6. CSF cytology did not demonstrate malignant cells. A magnetic resonance imaging (MRI) scan showed a small focus of increased signal at the T7 level (images not available). Developing progressive symptoms, including a sensory level at T6, he underwent a second surgical intervention (thoracic laminectomy and total excision of recurrent T6 ependymoma at UHS). The corresponding histology examination revealed similar appearances to his initial biopsy, confirming recurrent MPE. Following surgery, he underwent craniospinal radiotherapy (35Gy in 21 fractions with a focal boost to the involved area of thoracic cord T5-T7, total dose 50Gy in 31 fractions at UHS). He made a complete recovery following surgery and radiotherapy, returning to work as a draughtsman and playing badminton.

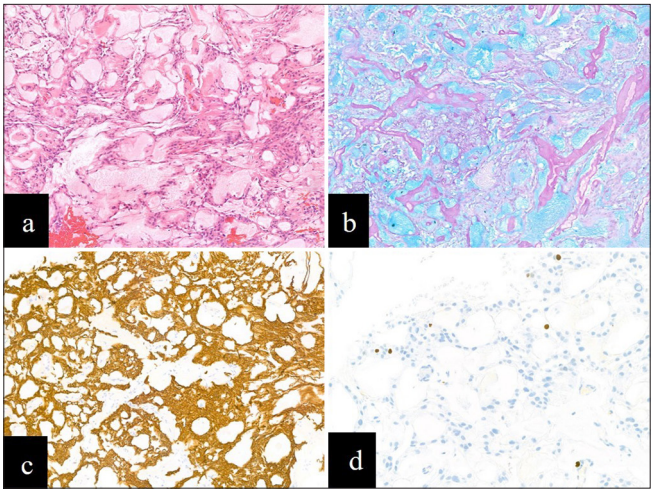

Figure 1: (a) Haematoxylin and eosin section showing a tumor composed of papillae lined by a single layer of cuboidal cells and blood vessels with surrounding myxoid material (x100).(b) Alcian blue highlights the prominent mucin-rich collars around numerous blood vessels (x100). (c) The tumor cells showed strong and diffuse immunolabelling for glial fibrillary acidic protein (x100). (d) The Ki67 proliferation index was low at <3% (x200).

He remained clinically and radiologically stable for the next 11 years before presenting with progressive numbness in his feet, extending up to buttocks, affecting mobility (1999). An MRI scan revealed a large tumor occupying the whole of the thecal sac from T12 to L5, with a second tumor at T10 causing cord compression (images not available). Consequently, the patient underwent emergency re-do thoracic laminectomy T9-T11 and lumbar laminectomy L3-L5 (third surgery at UHS); despite complete removal of the T10 lesion, the lumbar tumor could not be excised due to multiple nerve root infiltration. The subsequent histology was in keeping with previous examinations, i.e., recurrent MPE. He received further postoperative radiotherapy to T11-S2 (18 Gy in 10 fractions with a further boost below the conus of 5.4 Gy in 3 fractions at UHS). To consolidate treatment, the patient was offered postradiation chemotherapy with procarbazine, lomustine (CCNU), and vincristine 6-weekly (PCV chemotherapy). However, after 3 cycles, chemotherapy was discontinued due to concerns over bone marrow depletion and long bone marrow recovery. At this point, he had a Karnofsky performance status (KPS) of 90 with good power bilaterally but reduced sensation over thighs, buttocks, and perineal area with some difficulty in erectile function.

Approximately 13 years after his third surgery (2013), he had a rapid, progressive motor deterioration requiring a wheelchair. An MRI scan [Figure 2] reported an increase in the superior portion of the tumor with new impingement on

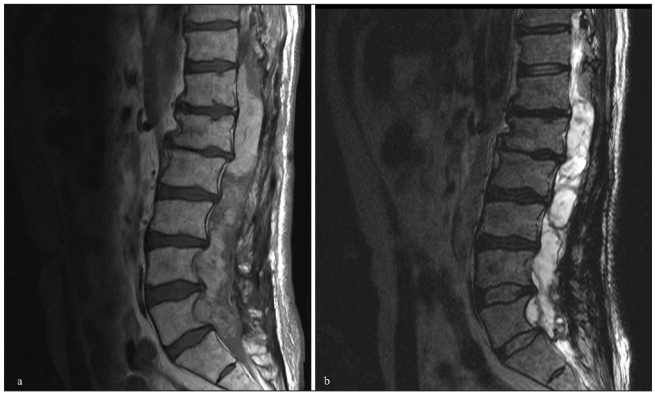

Figure 2: (a) T1-Gad and (b) T2 sagittal magnetic resonance imaging sequences demonstrating the tumor extending from the T11/T12 disc to below the L5-S1 disc.

the distal cord extending up to the T11-T12 disc; jointly, there was displacement of the terminal cord and enhancement on the front of the cord at T10-T11. He underwent a re-exploration and debulking at T12-L3 (fourth surgery at UHS) following multidisciplinary assessment, completely losing function in his lower limbs. Despite the latter, bowel and bladder function were maintained.

Approximately 10 months later (2014), an MRI scan [Figure 3] revealed clear progression of the tumor proximally, now extending to T10, leading to a trial of palliative temozolomide (TMZ) 4-weekly. However, a further interval MRI scan after 6 cycles of TMZ showed superior progression of the tumor with cord edema, ending any further systemic treatment. Due to progressive thoracic pain and diminished urinary control, he underwent elective extension of laminectomy and debulking of the thoracic progression in 2015 (fifth surgery at UHS), remaining on surveillance thereafter.

Over the next 8 years, his tumor slowly progressed, resulting in worsening bowel and bladder function, leading to the insertion of a colostomy and suprapubic catheter. He remained reasonably well, still mobilizing on his wheelchair. However, in 2023, he presented to the GP with low oxygen saturations. A chest X-ray was arranged demonstrating a right pleural effusion; the complementary computed tomography (CT) of the chest, abdomen, and pelvis showed multiple bilateral lung nodules and enlarged nodes in the axillae, para-aortic, and retroperitoneal regions [Figure 4]. A right axillary lymph node biopsy showed similar histological features to the primary tumor [Figure 5], confirming metastatic MPE. Of note, although the initial histology was assessed as grade 1 based on previous WHO guidelines (2016), the biopsy samples were upgraded to WHO grade 2 in accordance to the latest 2021 WHO classification.

His case was discussed at the National Ependymoma Multidisciplinary Group Meeting. The group concluded

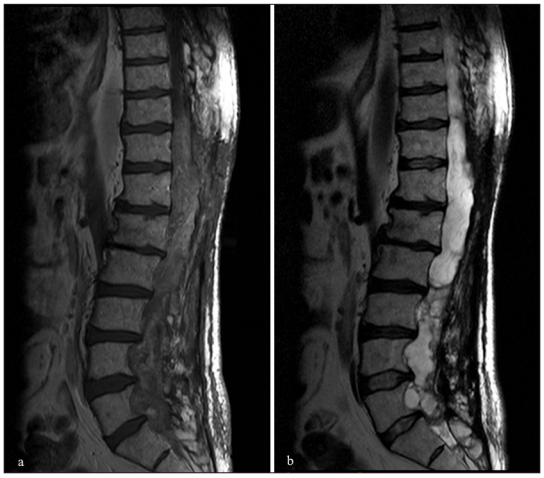

Figure 3: (a) T1-Gad and (b) T2 sagittal magnetic resonance imaging sequences demonstrating the tumor now extending from the T10 disc to below the L5-S1 disc.

that treatment options were limited with no role of further radiotherapy. Oral etoposide was suggested, yet his clinical condition heavily precluded further chemotherapy. Consequently, the patient was referred to the palliative care team for best supportive management. Sadly, the patient passed away in late January 2025, 39 years after his initial diagnosis, at the age of 63. A chronological summary of the patient's disease evolution and treatments is provided in Figure 6.

DISCUSSION

Background

Ependymomas are intramedullary tumors arising from ependymal glial cells lining the ventricles and central spinal canal.[16] They are the most common intramedullary spinal cord tumors in adults, accounting for 60 to 80% of spinal gliomas.[23] Ependymomas are classified according to anatomic site, histology, and molecular features.[14] MPE is biologically and morphologically distinct from other ependymomas.[1,14] Factually, MPE is a rare, slow-growing glial tumor originating predominately from the conus medullaris, cauda equina, or filum terminale,[2,14] typically found in young adults, with a median age diagnosis of 35–39 years and a slight male predominance.[2,16,23] MPE accounts for 13% of all spinal ependymomas and over 90% of tumors in the conus medullaris.[13] In keeping with our case, clinical presentation is typically with lower back pain with or without radicular features; in this context, symptoms can be present for months or even years before diagnosis due to the slow-growing nature of these tumors. Originally classified as grade 1 tumors, MPE was upgraded to grade 2 neoplasms in 2021, acknowledging that the likelihood of

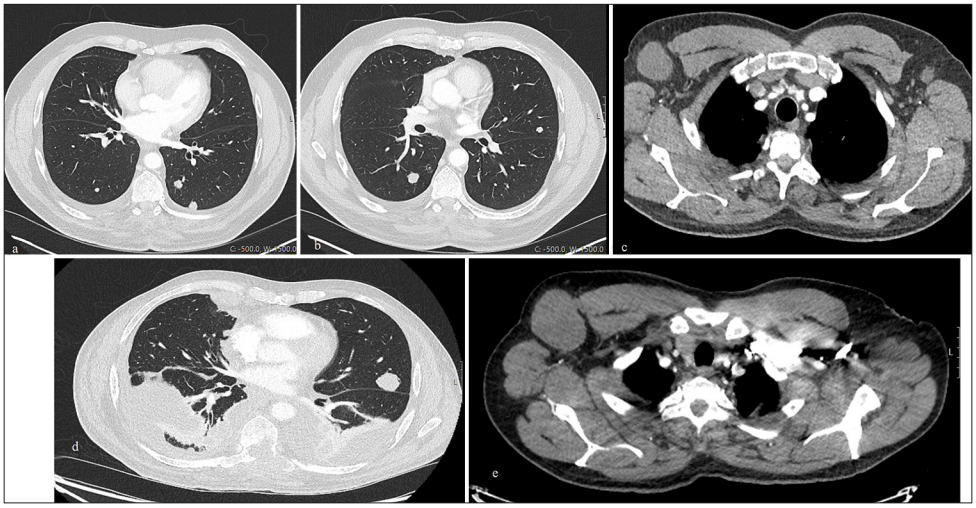

Figure 4: Axial computed tomography (CT) slices at initial metastatic presentation demonstrating (a and b) metastatic bilateral pulmonary nodules and (c) enlarged axillary nodes. Axial CT slices 1 year later demonstrating (d) progression of disease with extensive thoracic metastatic disease, bilateral pleural effusions and (e) further enlargement of axillary nodes.

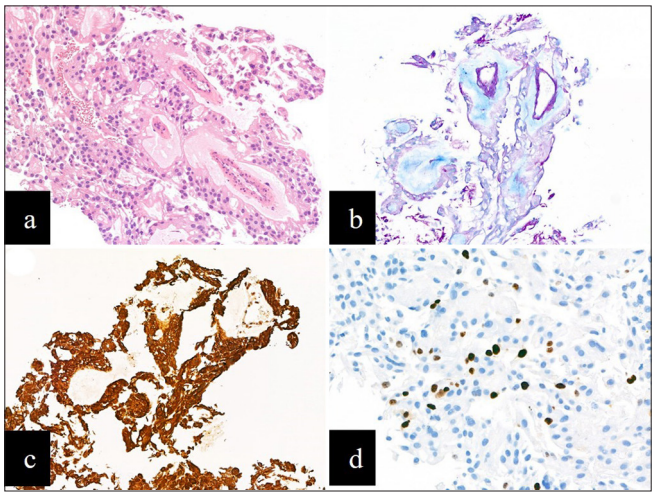

Figure 5: (a) Haematoxylin and eosin section of the metastatic deposit of myxopapillary ependymoma showing similar histological features to the primary tumor (x100). (b) Alcian blue highlights abundant mucin around blood vessels (x100). (c) The tumor cells showed strong and diffuse expression of glial fibrillary acidic protein (x100). (d) The Ki67 proliferation index was low to focally moderate at 2.5-7.5% (x200).

recurrence is higher than originally thought and similar to conventional spinal ependymoma.[14] As such, MPEs tend to recur, primarily locally, sometimes distally within the CNS, and rarely extra-neural.[13] The mechanism of spread could be through the bloodstream or lymphatic system or potentially from surgical seeding secondary to multiple operations.

Although remaining an extremely rare occurrence, extra-neural metastases of MPEs have been reported in the lung, pleura, mediastinum, liver, bone, cervix, diaphragmatic, abdominal, pelvic muscles, and lymph nodes.[2,4,8,9,13,15,16,18,21] Indeed, Mastantuoni *et al.* found only 14 reported cases of MPE with extra-neural, metastatic activity in the literature between 1955 and 2012.[16] Our complementary review on cases of extra-neural, metastatic MPE reported from 2012 to 2024 is listed in Table 1; the literature review was conducted in PubMed and includes cases (i) not included in the Mastantuoni literature review and (ii) with histological confirmation of MPE. To the best of our knowledge, <30 cases of extra-neural metastatic MPE have been reported to date (1955–2024), possibly due to factors such as underreporting, misdiagnosis, or unidentified cases.

In summary, extra-neural metastases of MPE are associated with worse prognosis;[3] regardless of recurrent or *de novo* metastasis, the 5-year survival is estimated to be 15%.[21] In line with our case, metastatic spread is more likely to manifest in those long-term survivors; in addition, MPE may undergo anaplastic transformation, gaining more malignant characteristics and enabling tumor spread.[8,11]

Treatment strategies-Surgery and radiotherapy

Obviously, due to the rarity of the entity, there is a lack of evidence on the best management of MPE at recurrence, particularly extra-neural metastatic disease. Consequently, most treatments are derived from previous case studies, series, or retrospective analytical work. The standard of care for initial MPE diagnosis is surgery, aiming to achieve a gross total resection (GTR).[2,3,18] Furthermore, the extent of GTR appears to be the most consistent factor in predicting prognosis, with GTR improving 5-year overall survival (OS) and progression-free survival (PFS) (98.8%

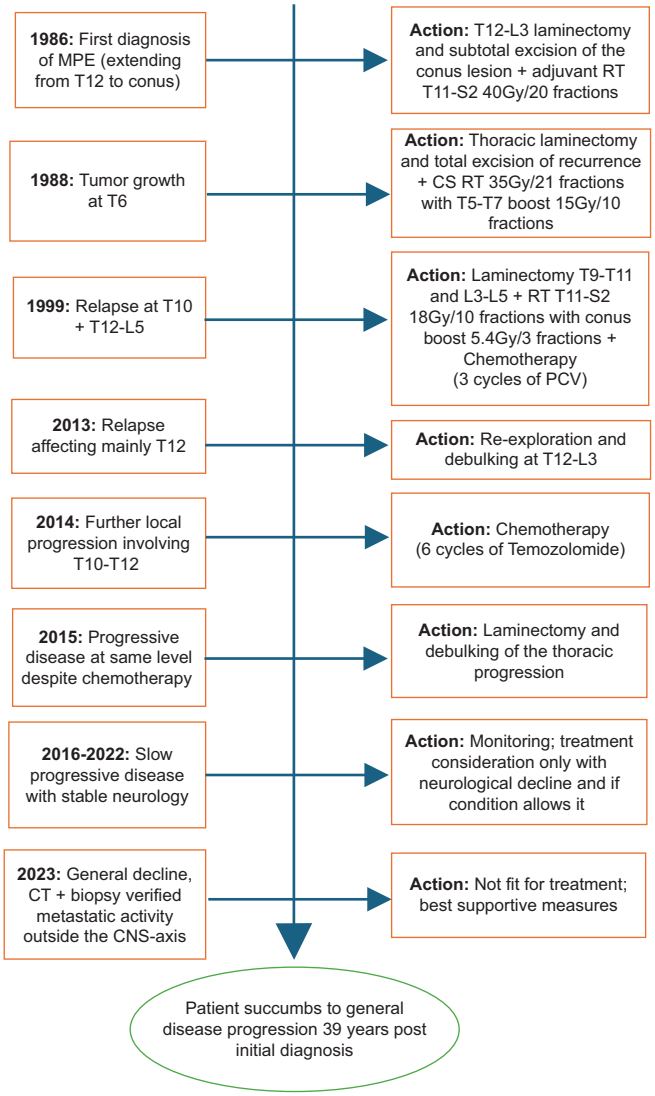

Figure 6: Chronological summary of clinical evolution and treatments given from first diagnosis to succumbing to disease (39-year follow-up).

and 97.9%, respectively).[17,20] However, as illustrated by this case, although the estimated 10-year OS exceeds 90%, local recurrence can occur in up to one-third of patients.[22] It is widely accepted that a sub-total resection (STR) is associated with a higher risk of recurrence;[3,17] in our case, the absence of radical resection at initial diagnosis due to precluding anatomical barriers may have been a contributing factor in the ensuing entangled evolution of the disease. It is nonetheless worth mentioning that, despite multiple lines of recurrence, our patient survived for 39 years postdiagnosis. In this context, adjuvant treatment (mainly radiotherapy) may have played a key role, at least in theory.

Indeed, the guidance for adjuvant radiotherapy varies depending on histological subtype and outcome at surgery.[3] For grade 1 tumors where a GTR is achieved, adjuvant radiotherapy is not recommended. For grade 2 or more, biopsy only, or when STR is achieved, it is acceptable to consider radiotherapy to improve tumor control.[4,17,20] However, the evidence for the impact on PFS and OS is mixed; a literature review of 348 patients with WHO grade 2 and 3 spinal ependymomas showed that adjuvant radiotherapy significantly prolonged PFS in cases of STR, with a median PFS of 48 months for STR and 96 months for STR followed by radiotherapy.[17] Radiotherapy did not significantly improve OS in patients who had STR alone and adjuvant radiation.[17] Notably, this review excluded 77 patients with grade 1 MPE who had undergone surgical resection. There were also no significant differences in total radiation dose <50 Gy versus >50 Gy on recurrence or survival. A study conducted at the Anderson Cancer Centre of MPE patients who had undergone surgery and adjuvant radiotherapy found that regardless of the extent of the resection, radiotherapy appears to reduce the rate of tumor progression significantly.[1] Celli *et a*l. reviewed a series of 28 ependymomas arising in the filum terminale. They found that tumor confinement in that region and gross total resection reduced the risk of recurrence. In contrast, postoperative radiotherapy had no additional reduction in recurrence risk, regardless of the extent of resection.[6] In spite of this, the European Association of Neuro-Oncology (EANO) recommends postoperative radiotherapy with doses ≥50Gy in case of incomplete resection.[20] Though in agreement with the latter, we also need to acknowledge that, in accordance to institutional experience, delivering a total dose beyond the threshold of 50/54Gy (2-1.8Gy per fraction, respectively) will unavoidably increase the risk of radiation myelopathy.

As mentioned previously, our patient survived almost four decades after the initial diagnosis despite experiencing several episodes of recurrence matching the timeline of survival of some of the cases identified by Mastantuoni *et al*.;[16]. Although not able to achieve full control, it is reasonable to believe that surgery and consolidating radiotherapy may have had a delaying effect on disease activity, positively impacting survival. In contrast, the same cannot be extrapolated to chemotherapy, considering the patient's limited response to PCV and TMZ. Historically, systemic chemotherapy rarely has a role to play in the management of primary ependymoma in adults, particularly at initial diagnosis. As a matter of fact, EANO has stated that in case of relapse, consideration should be given to re-operation, re-irradiation, and chemotherapy.[20] The management of cases described in the literature has also fallen in line with this recommendation with patients undergoing multiple surgeries and re-irradiation for recurrent MPE as does our case.[11]

Table 1: Cases of extra CNS metastases of MPE published in the literature between 2012 and 2024.

Author and Year	Age, Sex	Primary location	Treatment	Metastatic location	Treatment	Time interval to metastases	Overall survival
Fegerl and Marosi 2012[10]	59, F	Sacrum	Surgery	Pleural	1. Temozolomide 2. Imatinib 3. Sorafenib	20 years	OS not reported
Guzin *et al*., 2016[13]	34, F	Sacrum	Surgery	Cervix	1. Hysterectomy, omentectomy, pelvic lymphadenectomy	9 years	Reported alive at publication, OS=10 years
Batich *et al*., 2019[4]	30, M	Sacrum	Surgery	Lung	1. Wedge resection	2 years	Reported alive at publication; OS not reported
Deniel *et al*., 2019[8]	39, F	Filum Terminale	Surgery	Lung, mediastinum, pleura	1. Temozolomide	13 years	The patient died, OS=13 years
Mahalingam *et al*., 2023[15]	48, F	Pelvis	Surgery	Lung	1. Carboplatin-e toposide 2. Temozolomide 3. Ismodegib 4. Olaparib-temozolomide	20 years	The patient died, OS not reported
Tapia Rico *et al*., 2020[21]	25, F	Sacrum	Surgery	Lung	1. Tislelizumab x27 cycles on trial 2. Temozolomide 3. Carboplatin	*De novo*	Reported alive at publication, OS=4 years
Mastantuoni *et al*., 2022[16]	39, M	Cauda Equina	Surgery	Paraspinal muscles	1. Surgical resection	30 years	Reported alive at publication, OS=30 years
Fecker *et al*., 2024[9]	29, F	Sacrum	None	Pleura, lung, intravascular space	None	*De novo*	The patient died, OS not reported
Riegel *et al*., 2024[18]	35, F	Sacrum	Surgery	Pleura, lung, pelvis	1. Temozolomide and lapatinib	11 years	Reported alive at publication; OS not reported

CNS: Central nervous system, MPE: Myxopapillary ependymomas, OS: Overall survival

Treatment strategies–Systemic treatment (chemotherapy, targeted therapy, and immunotherapy)

Often the case of multiple lines of local recurrence and/or distant metastases, further surgery and radiotherapy may not be feasible; in this framework, systemic therapies are contemplated and worth discussing. TMZ is often used in the treatment of glial tumors, with its use being extended to ependymal tumors. There is a level of evidence to suggest a response to TMZ in chemotherapy-naïve patients with a median PFS of 9.69 months and OS of 30.55 months of a retrospective study of 18 patients with recurrent intracranial ependymomas.[19] In our complementary review of the literature, single agent TMZ was used in 4 cases with metastatic disease [Table 1]; one of the patients died within a few weeks after initiation of TMZ,[8] two patients progressed after the first interval imaging after commencing treatment,[10,15] and one patient progressed after 10 months of 2nd line TMZ following response with first-line immunotherapy.[21] The patient discussed in our case had 6 cycles of TMZ in the second-line setting before radiological evidence of progression. These cases suggest a timid response to single-agent TMZ, as further demonstrated in Table 1. However, stronger responses have been observed by combining TMZ with Lapatinib, a tyrosine kinase inhibitor of epidermal growth factor receptor (ErbB1) and human epidermal growth factor receptor 2/neu (ErbB2), a mutation seen in ependymal tumors [Table 1].[18] This patient with pleural, lung, and pelvic metastases had clinical improvement in her symptoms with a mixed radiological

response after 12 cycles of this combination treatment.[18] TMZ has also been used in combination with Olaparib, a poly (ADP-ribose) polymerase (PARP) inhibitor, and found to have a durable response after 10 cycles.[15] In a patient with metastatic MPE, the multikinase inhibitor, sorafenib, stabilized the growth of 3 pleural masses in a patient for 12 months, further lending weight to the use of targeted therapy if identified on histology.[10]

Oral etoposide was suggested by the National Ependymoma Multidisciplinary Group Meeting as a treatment option for our patient. Unfortunately, he was unsuitable to start treatment. Yet cases with positive outcomes have been reported; a phase II trial comprising 10 patients with recurrent intramedullary spinal ependymomas was given oral etoposide, having failed surgery, radiotherapy, or salvage chemotherapy.[7] The median PFS was 15 months, and the median OS was 17.5 months.[7] 2 of the 10 patients had prior PCV chemotherapy, as did our patient. Oral etoposide was thought to be well tolerated with moderate toxicity.

Cisplatin has also been reported to have higher response rates compared with nonplatinum-based chemotherapy, but this did not translate to significant PFS or OS in a small retrospective analysis of 28 adults with recurrent intracranial ependymomas.[5] In a small retrospective review of cranial and spinal ependymomas, 8 patients received carboplatin, with 3 patients demonstrating a prolonged PFS, who were alive 7 years after disease recurrence.[5] Platinum-based chemotherapy was used in just one of the cases presented in Table 1 and only as a third-line option.[21]

Bevacizumab, a monoclonal antibody that binds to and inhibits vascular endothelial growth factor (VEGF), has been observed to have a PFS of 6.4 months and OS of 9.4 months in a retrospective case series of 8 patients with intracranial ependymomas treated with bevacizumab alone or in combination with other chemotherapy.[12] Most of these patients had prior treatment with TMZ or carboplatin chemotherapy. VEGF receptors are found on ependymal cells, which makes bevacizumab a potential therapeutic option to be explored further in the future.[12]

Over the past 30 years, immunotherapy has shown remarkable benefits and is now frequently used as systemic therapy across multiple tumor sites; yet, its role is less well established in tumors of the CNS. Tapia Rico *et al*. successfully treated a patient with metastatic spinal MPE with the trial drug, tislelizumab, an anti-PD-1 antibody [Table 1].[21] The patient remained stable for 18 months with no side effects. She had not received any prior chemotherapy, and a trial was considered because she had no significant co-morbidities with a good performance status. This case lends weight to the consideration of trials for patients with extra-neural metastatic MPE where standard systemic chemotherapy has shown modest benefits. Seemingly, based on what is found in the literature, immunotherapy may be considered if there is no urgency for tumor control (slower disease activity) and in fit patients without significant burden of disease.

CONCLUSION

Although a rare occurrence, MPE can metastasize outside the CNS. To our knowledge, there are <30 cases of extra-cranial metastatic MPE reported since 1955, which heavily precludes the obtention of reliable clinical data and implementation of evidence-based guidelines. Consequently, there is no current consensus on the treatment of extra-neural metastatic MPE. With this in mind, case reports and series remain of utter importance to share experience and help customize management. From this angle, surgery, and radiotherapy are still used in the face of CNS recurrence and "limited" extra-neural spread, depending on the patterns of invasion, previous treatments, and KPS. Although chemotherapy's efficiency on MPE remains questionable, positive outcomes from targeted agents and immunotherapy (alone or combined) have been reported, ultimately warranting further exploration. Finally, long-term, regular, follow-up of these patients is strongly recommended due to the long latency before metastatic presentation.

Acknowledgment: Our sincere expression of gratitude to the Fothergill Neuroscience Society (UK) for kindly funding the publishing fees relevant to this case report, a much-appreciated gesture.

Ethical approval: Institutional Review Board approval is not required.

Declaration of patient consent: The authors certify that they have obtained all appropriate patient consent.

Financial support and sponsorship: Fothergill Neuroscience Society (UK).

Conflicts of interest: There are no conflicts of interest.

Use of artificial intelligence (AI)-assisted technology for manuscript preparation: The authors confirm that there was no use of artificial intelligence (AI)-assisted technology for assisting in the writing or editing of the manuscript and no images were manipulated using AI.

REFERENCES

1. Akyurek S, Chang EL, Yu TK, Little D, Allen PK, McCutcheon I, *et al.* Spinal myxopapillary ependymoma outcomes in patients treated with surgery and radiotherapy at M.D. Anderson cancer center. J Neurooncol 2006;80:177-83.
2. Almatrafi FR, Aseeri AM, Alqahtani MF, Al Mulla L, Al-Jubran S, AlOmair MA, *et al.* Myxopapillary ependymoma. A case report of rare multicentric subtype and literature review. Med Arch 2023;77:150-4.
3. Al-Mistarehi AH, Parker M, Xia Y, Hasanzadeh A, Horowitz MA, Raj D, *et al.* Survival factors in 1580 adults with spinal ependymoma: Insights from a multicenter oncology database.

World Neurosurg 2024;190:e920-30.
4. Batich KA, Riedel RF, Kirkpatrick JP, Tong BC, Eward WC, Tan CL, *et al.* Recurrent extradural myxopapillary ependymoma with oligometastatic spread. Front Oncol 2019;9:1322.
5. Brandes AA, Cavallo G, Reni M, Tosoni A, Nicolardi L, Scopece L, *et al.* A multicenter retrospective study of chemotherapy for recurrent intracranial ependymal tumors in adults by the gruppo italiano cooperativo di neuro-oncologia. Cancer 2005;104:143-8.
6. Celli P, Cervoni L, Cantore G. Ependymoma of the filum terminale: Treatment and prognostic factors in a series of 28 cases. Acta Neurochir (Wien) 1993;124:99-103.
7. Chamberlain MC. Salvage chemotherapy for recurrent spinal cord ependymona. Cancer 2002;95:997-1002.
8. Deniel A, Marguet F, Beaussire L, Tobenas-Dujardin AC, Peillon C, Gambirasio MA, *et al.* TERTp mutation detection in plasma by droplet-digital polymerase chain reaction in spinal myxopapillary ependymoma with lung metastases. World Neurosurg 2019;130:405-9.
9. Fecker A, Maanum KA, Shahin MN, Hakar M, Wright lii JM. Myxopapillary ependymoma metastasis mimicking pulmonary embolism: An illustrative case. Asian J Neurosurg 2024;19:551-5.
10. Fegerl G, Marosi C. Stabilization of metastatic myxopapillary ependymoma with sorafenib. Rare Tumors 2012;4:134-7.
11. Fujimori T, Iwasaki M, Nagamoto Y, Kashii M, Sakaura H, Yoshikawa H. Extraneural metastasis of ependymoma in the cauda equina. Global Spine J 2013;3:33-40.
12. Green RM, Cloughesy TF, Stupp R, DeAngelis LM, Woyshner EA, Ney DE, *et al*. Bevacizumab for recurrent ependymoma. Neurology 2009;73:1677-80.
13. Guzin K, Bozdag H, Aydin A, Sahin S, Ozkanli S. Uterine cervix metastasis of myxopapillary ependymoma originated from the spinal cord. Balkan Med J 2016;33:235-8.
14. Louis DN, Perry A, Wesseling P, Brat DJ, Cree IA, Figarella-Branger D, *et al.* The 2021 WHO classification of tumors of the central nervous system: A summary. Neuro Oncol 2021;23:1231-51.
15. Mahalingam P, Smith S, Lopez J, Sharma RK, Millard T, Thway K, *et al.* PARP inhibition utilized in combination therapy with olaparib- temozolomide to achieve disease stabilization in a rare case of $BRCA_1$-mutant, metastatic myxopapillary ependymoma. Rare Tumors 2023;15:20363613231152333.
16. Mastantuoni C, Tortora F, Tafuto R, Tortora M, Briganti F, Franca RA, *et al.* Extra-neural metastases of late recurrent myxopapillary ependymoma to left lumbar paravertebral muscles: Case report and review of the literature. Brain Sci 2022;12:1227.
17. Oh MC, Ivan ME, Sun MZ, Kaur G, Safaee M, Kim JM, *et al.* Adjuvant radiotherapy delays recurrence following subtotal resection of spinal cord ependymomas. Neuro Oncol 2012;15:208-15.
18. Riegel DC, Fonkem E, Connelly JM. Treatment of extraneural metastases of myxopapillary ependymomas with dose-dense temozolomide and lapatinib. Cureus 2024;16:e67928.
19. Rudà R, Bosa C, Magistrello M, Franchino F, Pellerino A, Fiano V, *et al.* Temozolomide as salvage treatment for recurrent intracranial ependymomas of the adult: A retrospective study. Neuro Oncol 2015;18:261-8.
20. Rudà R, Reifenberger G, Frappaz D, Pfister SM, Laprie A, Santarius T, *et al.* EANO guidelines for the diagnosis and treatment of ependymal tumors. Neuro Oncol 2018;20:445-56.
21. Tapia Rico G, Townsend A, Price T, Patterson K. Metastatic myxopapillary ependymoma treated with immunotherapy achieving durable response. BMJ Case Rep 2020;13:e236242.
22. Weber DC, Wang Y, Miller R, Villà S, Zaucha R, Pica A, *et al.* Long-term outcome of patients with spinal myxopapillary ependymoma: Treatment results from the MD anderson cancer center and institutions from the rare cancer network. Neuro oncol 2014;17:588-95.
23. Welch W, Schiff D, Gerszten P. UpToDate; 2025. Available from: https://www.uptodate.com/contents/spinal-cord-tumors?csi=34b9ae28-6109-43b3-8ec7-62f7b19617f1&source=contentshare [Last accessed on 2025 Jan 03].

How to cite this article: Jayawardena D, Yates J, Clarke E, Sinclair G. Extra-neural metastases of recurrent myxopapillary ependymoma: A patient case and literature review. Surg Neurol Int. 2025;16:182. doi: 10.25259/SNI_190_2025